

# PATENT SPECIFICATION

346,270

Application Date: Dec. 5, 1929. No. 37,347 / 29.

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## PROVISIONAL SPECIFICATION.

### Improvements in Nozzles, more especially Intended for use with Fire Hose.



I, JOSEPH O'HANLON, a citizen of the United States of America, of 1938, East 15th Street, Brooklyn, in the County of Kings, and State of New York, United States of America, do hereby declare the nature of this invention to be as follows:—

This invention has for its object to provide an improved nozzle more particularly intended for use with a line of fire hose which will permit discharge of water at an angle to the hose. Another object of the invention is to produce a nozzle which has no back pressure.

The profession of fire-fighting is unique in the character of the problems it faces. No two buildings are alike nor were there ever two fires in them which were alike. Nowhere else can one find the ever changing situations, the unexpected conditions calling for instant cool decision and adaptation of attack in spite of excitement, heat, gas and smoke. Nowhere else must the delivery and direction of a stream of water be changed without the loss of appreciable times, as must take place in effective fire-fighting. The entire character of a fire may change several times within as many minutes, and experienced fire-fighters know it is impossible to tell with what they will be faced from one minute to the next. Few nozzles are actually able to qualify under these severe conditions. The nozzles must be simple, portable, of universal applicability and highly efficient. In the field of the present invention—namely the nozzle used on the end of the hose line—there has been practically no change for many years, despite the obvious inadequacy of the nozzles now used.

The need of changing the direction of the stream relative to the hose arises in cellar fires and sub-cellar fires, fires in adjoining rooms, fires in cock-lofts, fires under floors, or in walls, partitions and ceilings, and fires which are too hot to approach directly. Various nozzles have been designed to meet these situations, but no one nozzle is of universal applicability and none has the efficiency of a straight nozzle. In order to meet the various situations in which it is necessary

to throw the stream at an angle to the hose, the average fire department has to carry at least four or five different nozzles, each for a slightly different situation. None of these nozzles has an hydraulic efficiency approaching that of a straight nozzle, nor am I aware of any nozzle that can be used for a cellar fire and which can be put on the hose line without shutting down the pressure at the engine. Neither am I aware of any single nozzle which is adapted to meet all conditions in which it is desired to throw a stream at an angle to the hose. Nor do I know of any such nozzle which also may be used with equal effectiveness to throw a straight stream.

It is an object of my invention to provide a universal fireman's nozzle for use in directing a stream at an angle to the part of the hose held by the fireman, and also capable of effective use when the stream is directed straight ahead.

Another object is to provide a fireman's nozzle which will not decrease the hydraulic efficiency and which will reduce back pressure thus permitting easier handling under higher pressures.

According to my invention the nozzle comprises a tip which may be identical with the tip used on the usual nozzle, a union, a flexible metal tube secured at one end in the union and a coupling on the other end of the nozzle. If desired there may be a section of rigid tubing between the tube and the coupling. The flexible tube is of a known type. It has internal circumferential grooves which may be helical. The length of the tube is preferably such as to give a bend of 90° or thereabouts, and may, if desired, be between eighteen and twenty-four inches long. Such a length of tube one and one half inches in diameter, when bent uniformly, gives a radius of curvature equal to more than two and one half diameters of the pipe, it being found that for best hydraulic efficiency such a minimum ratio is necessary.

In a preferred construction the nozzle comprises the usual tapered tip to gather the stream together, a spirally wound flexible metal tube secured at one end to the tip and of about the same internal

diameter as the tip, a coupling attached to the other end of the tube and a shoe connected to the tip and the coupling. If desired a section of rigid tube may be screwed onto the coupling to give ease in handling. In this example of nozzle the tip is one and one quarter inches in diameter at the outer end and the tube is one and one half inches in diameter. The length of the tube is such as to give a bend of 90° or thereabouts at its maximum curvature, and for this purpose may be between eighteen and twenty-four inches in length. Such a piece of tubing when bent gives a uniform minimum radius of curvature of the order of one-fifth of the diameter of the pipe, being found that for hydraulic efficiency a maximum curvature giving a ratio of that order is necessary. The tube being articulated it will be obvious that the nozzle can be bent to any desired angle or made straight.

The shoe is adapted to make the nozzle a rigid unit no matter at what angle it is set. The shoe is U-shaped with its open side toward the flexible tube and it is of such a cross section and curved in such an arc that when the flexible tube is bent to 90° it lies in the shoe and is supported by it. The shoe is pivotally connected to both the tip and the coupling. There is a lug projecting laterally from the rear end of the tip and the end of the shoe pivoted to the end of this lug. This pivot point is preferably one side of the centre line of the hose to give plenty of room for movement of the shoe. The coupling has a pivot point at one side and the shoe is fastened there. The distance between the ends of the tube is less when the tube is bent than when it is straight. Because of this fact it was necessary to put this pivot point at the exact point where it now is in order to make the point a fixed pivot.

For the purpose of fixing the nozzle at any desired angle a rack and locking pin are provided. On the coupling are two lugs each having an overhang facing outward. On the underside of each overhang is a slot adapted to receive the rack. The locking pin lies across the space between the lugs and is rotatably mounted in each lug. In order to rotate the locking pin a handle with a finger hold is formed integrally with the portion of the pin between the lugs. The two parts of the pin which lie in the slots are cut half round so that when the pin is turned one way the slot is filled and when turned the other way the slot is clear. The cooperating rack is formed out of the edges of the shoe by making the edges large enough to fill the slots and putting notches

in the edges just large enough to receive the half round portions of the pin. It will be obvious that when the pin is thrown to locking position the entire nozzle becomes a rigid unit with the shoe supporting the tip.

In case it is desired to suspend the nozzle in a hole, a ring is provided at any suitable point such as the rigid section, hereinafter referred to, and a chain and cross-bar fastened thereto. The cross-bar lies across the hole and supports the nozzle so that it can be turned in any direction either vertically or horizontally.

It is sometimes desirable to have a piece of rigid pipe attached to the coupling in order that the nozzle may be handled and manipulated more easily. This may be effected by screwing a rigid section into the coupling with a swivelled reducing section on the other end of the rigid section. This swivelled reducing section gives a female coupling suitable for connection to the hose, the coupling may be adapted to connect to the butt end of a two and one half inch diameter hose. If desired the coupling can be fastened directly to the hose by means of an ordinary reducing coupling and further the nozzle may if desired be attached to a rigid pipe, such for instance as a deck pipe, water tower or monitor.

The relative dimensions of all the parts of the nozzle may have an internal diameter substantially equal to that of the discharge end of the tip and that this diameter is less than that of the hose line. The nozzle, therefore, provides in effect a cylindrical extension having a diameter substantially equal to that of the tip. The swivelled reducing section permits of the nozzle being turned in any direction and if desired a handle may be provided on the rigid section to make this manipulation easier.

The outstanding merit of the nozzle described above is its capability of effective use under the most difficult and varied conditions. It is found that when the flexible tube is bent, the hydraulic efficiency is not noticeably different from that obtainable with the flexible tube straight. A notable advantage present with this nozzle, whether bent or straight, is that much higher pressures may be used than with the controlling nozzle or with the so-called "play-pipe" than has hitherto been possible. The hose seems to have substantially no back pressure compared with any other nozzle and as a result the line can be handled by fewer men at higher pressures.

Probably the most common need for a nozzle to throw a stream around the corner is in fighting cellar fires. With the

new tool a stream can be delivered the full length of the average cellar, making it unnecessary for anyone to enter the cellar and to expose himself to the dense smoke and gas commonly present with such fires. The nozzle may be introduced into the cellar through a hole in the floor to deliver a stream either lengthwise or crosswise of the beams, or it may be introduced through a window, stairway, hatchway or other opening when it is not possible to reach the floor and to make a hole in it.

The nozzle is of equal value in fighting fires within walls or between partitions or in hallways where the heat prevents direct approach to the fire. A similar use is found where a wall has been breached, but because of heat, men cannot pass through. A stream may be put directly through the breach and also along the walls, the nozzle being held on the safe side of the breach. A similar condition is met in roof fires when the hose is brought up over the coping. If the men cannot go onto the roof, the tool may be bent and a stream may be delivered directly to the blaze. In ship or dock fires the tool makes possible effective delivery of the stream through portholes, or hatchways, or under the pier.

The before-mentioned chain acts as supporting means and permits mounting in other ways than that described. For instance, it may be desired to throw a stream of water from one building into another across a street or yard. The flexible tube may then be set straight, resting on a window sill, and the chain secured outside the window.

The metal tube preferably used for the flexible tube may, if desired, be of the spirally wound type and is so very rugged that it is admirably suited to the work. The grooves found in a spirally wound flexible, metal tube are thought to be an element contributing to the hydraulic efficiency of the nozzle. It should be noted that the grooves inside the tube are spirals when the metal tube is spirally wound and nearly at right angles to the direction of movement of the water, the pitch being less than the diameter of the tube. It might also be noticed that when the tube is bent the spaces between the strands are greater on the outer wall of the bend than when the tube is straight. It has been found that the construction described practically eliminates the so-called back pressure and that the stream thrown by the nozzle when bent is as good as a stream thrown by the ordinary straight nozzle. The flexible tube adds greatly to the number of uses to which the nozzle may be put since the hydraulic efficiency is practically the same whether the nozzle is bent or straight, and, therefore, the nozzle may be kept on the hose after the "around the corner" work is done and a straight nozzle is desired. The ease with which the nozzle may be held even under high pressures is a merit which is present both when the nozzle is straight and when bent.

Dated this 5th day of December, 1929.

J. Y. & G. W. JOHNSON,  
47, Lincoln's Inn Fields,  
London, W.C. 2,  
Agents.

## COMPLETE SPECIFICATION.

### Improvements in Nozzles, more especially Intended for use with Fire Hose.

I, JOSEPH O'HANLON, a citizen of the United States of America, of 1938, East 15th Street, Brooklyn, in the County of Kings, and State of New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to nozzles more particularly intended for use with a line of fire hose, of the kind in which the nozzle comprises a flexible tubing and means whereby the said tubing can be bent so that the issuing stream of water can be projected at a greater angle, relatively to the hose line, than can be effected with nozzles of the straight type,

and this invention has for its object to provide an improved nozzle of the aforesaid flexible type.

The profession of fire-fighting is unique in the character of the problems it faces. No two buildings are alike nor were there ever two fires in them which were alike. Nowhere else can one find the ever changing situations, the unexpected conditions calling for instant cool decision and adaptation of attack in spite of excitement, heat, gas and smoke. Nowhere else must the delivery and direction of a stream of water be changed without the loss of appreciable time, as must take place in effective fire-fighting. The entire character of a fire may change several times within as many minutes, and

experienced fire-fighters know it is impossible to tell with what they will be faced from one minute to the next. Few nozzles are actually able to qualify under these severe conditions. The nozzles must be simple, portable, of universal applicability and highly efficient.

According to this invention a fire nozzle adapted to be set to direct a stream of water either straight ahead or at an angle to the end of the hose to which it is attached, comprises a tapered tip to gather the stream, a spirally wound flexible metallic tube on the said tip having a uniform diameter substantially equal to the internal diameter of the said tip and a coupling on the other end of the said tube and adjustable supporting means attached to the said tube adjacent each end adapted to fix the distance between the ends of the said tube.

A preferred embodiment of the invention is hereinafter described and illustrated in the accompanying drawings in which:—Figures 1 and 2 shew in plan and elevation respectively, a nozzle comprising a flexible tube and a shoe in accordance with my invention the flexible tube being shewn straight. Figure 3 is an elevation similar to Figure 2 but shewing the flexible tube bent to 90°; Figure 4 is an elevation of the coupling end of the nozzle; Figure 5 is a section taken on the line 5—5 of Figure 1; Figure 6 is a section taken on the line 6—6 of Figure 2; Figure 7 is a section taken on the line 7—7 of Figure 3; Figure 8 is a vertical section through the floor of a building shewing the complete device in position to direct a stream under a floor onto a cellar fire; and Figure 9 is a detail of the flexible tube when bent.

Referring to the example shewn in the drawings the nozzle itself comprises the usual tapered tip 10 to gather the stream together, a spirally wound flexible metal tube 12 secured to a union 13 carrying the tip, the tube being about the same internal diameter as the discharge end of the tip, a coupling 14 attached to the other end of the tube and a shoe 11 connected to the tip and the coupling. The tube 12 has helical internal circumferential grooves 31. In the example shewn in the drawings the tip 10 is one and one quarter inches in diameter at the discharge end and the tube 12 is one and one half inches in diameter. The length of the tube 12 is such as to give a bend of 90° or thereabouts at its maximum curvature in use, and for this purpose may be between eighteen and twenty-four inches in length. Such a length of tube one-and-one half-inches in diameter, when bent uniformly, gives a uniform

radius of curvature equal to more than two and one half diameters of the pipe, it being found that for best hydraulic efficiency such a minimum ratio is necessary. The tube 12 being articulated it will be obvious that the nozzle can be bent to any desired angle or made straight.

The shoe 11 is adapted to make the nozzle a rigid unit no matter at what angle it is set. The shoe is U-shaped in cross-section with its open side toward the flexible tube 12 and it is curved in such an arc that when the flexible tube is bent to 90° the latter lies in the shoe and is supported by it. The shoe 11 is in effect pivotally connected to both the tip 10 and the coupling 14. For this purpose there is a lug 15 projecting laterally from the rear end of the union 13 and the end of the shoe is pivoted to the end of this lug. This pivot point is preferably on one side of the centre line of the hose to give plenty of room for movement of the shoe 11. The coupling 14 has a pivot point 17 at one side and the shoe 11 is fastened there. In the example of hose shewn in the drawings the distance between the ends of the tube 12 is less when the tube is bent than when the tube is straight. Because of this fact it was necessary to put this pivot point 17 at the exact point where it now is in order to make the point a fixed pivot.

For the purpose of fixing the nozzle at any desired angle a rack on each side of the shoe 11 and a locking pin 19 are provided. On the coupling 14 are two lugs 16 each having an overhang facing outward. On the underside of each overhang is a slot 18 adapted to receive the rack. The locking pin 19 lies across the slot between the coupling 14 and the lugs 16 and is rotatably mounted in each lug. The two parts of the pin 19 which lie in the slots 18 are cut half round. In order to rotate the locking pin 19 a handle 20 with a finger hold is formed integrally with the portion of the pin between the lugs 16. The co-operating racks are formed out of the edges 21 of the shoe 11 by making the edges large enough to fill the slots 18 and forming notches 22 in the edges just large enough to receive the half round portions of the pin 19 when the latter is turned down and yet be free of the pin when the latter is turned up. It will be obvious that when the pin 19 is thrown to locking position the entire nozzle becomes a rigid unit with the shoe 11 supporting the tip 10. It will be obvious that other bracing means can be used to make the flexible tube rigid.

In case it is desired to suspend the nozzle in a hole, a ring 23 is provided at

any suitable point such as the rigid section hereinafter referred to, and a chain 24 secured to a cross-bar 25. The cross-bar lies across the hole and supports the nozzle so that it can be turned in any direction either vertically or horizontally.

It is sometimes desirable to have one or more pieces of rigid pipe attached to the coupling in order that the nozzle may be handled and manipulated more easily. This may be effected, as shewn in Figure 8, by screwing a rigid section 26, into the coupling 14 with a swivelled reducing section 27 on the other end of the rigid section. This swivelled reducing section 27 gives a female coupling suitable for connection to the hose, and the coupling may be adapted to connect to the butt end of a two and one half inch diameter hose. If desired the coupling 14 can be fastened directly to the hose by means of an ordinary reducing coupling and further the nozzle may if desired be attached to a rigid pipe, such for instance as a deck pipe, water tower or monitor nozzle.

The parts of the nozzle have an internal diameter substantially equal to that of the discharge end of the tip 10 and this diameter is of course less than that of the hose line. The nozzle, therefore, provides in effect a cylindrical extension having a diameter substantially equal to that of the tip 10. The swivelled reducing section 27 permits of the nozzle being turned in any direction and if desired a handle 28 may be provided on the rigid section 26 to make this manipulation easier. An indicator 29 may also be provided on the rigid section 26 to shew in which direction the stream is projected.

The outstanding merit of the nozzle in accordance with this invention is its capability of effective use under the most difficult and varied conditions. It is found that when the flexible tube is bent, the hydraulic efficiency is not noticeably different from that obtainable with the flexible tube straight. A notable advantage present with this nozzle, whether bent or straight, is that much higher pressures may be used than with the controlling nozzle or with the so-called "play pipe" than has hitherto been possible. The hose has substantially no back pressure compared to any other nozzle and as a result the line can be handled by fewer men at higher pressures.

Probably the most common need for a nozzle to throw a stream around the corner is in fighting cellar fires. With a nozzle in accordance with my invention a stream can be delivered the full length of the average cellar, making it unnecessary for anyone to enter the cellar and to ex-

pose himself to the dense smoke and gas commonly present with such fires. The nozzle may be introduced into the cellar through a hole in the floor to deliver a stream either lengthwise or crosswise of the beams, or it may be introduced through a window, stairway, hatchway or other opening when it is not possible to reach the floor and to make a hole in it.

The nozzle is of equal value in fighting fires within walls or between partitions or in hallways where the heat or limited space prevents direct approach to the fire. A similar use is found where a wall has been breached, but because of heat, men cannot pass through. A stream may be put directly through the breach and also along the walls, the nozzle being held on the safe side of the breach. A similar condition is met in roof fires when the hose is brought up over the coping. If the men cannot go onto the roof, the nozzle may be bent and a stream may be delivered directly to the blaze. In ship or dock fires the nozzle makes possible effective delivery of the stream through port-holes, or hatchways, or under the pier.

The before-mentioned chain 24 acts as supporting means and permits mounting in other ways than that shewn in Figure 8. For instance, it may be desired to throw a stream from one building into another across a street or yard. The flexible tube may then be set straight, resting on a window sill, and the chain 24 secured outside the window.

The metal tube used for the flexible tube is of the spirally wound type and is so very rugged that it is admirably suited to the work. The grooves found in a spirally wound flexible metal tube are thought to be an element contributing to the hydraulic efficiency of the nozzle. It should be noted that the spiral grooves inside the tube are nearly at right angles to the direction of movement of the water, the pitch being less than the diameter of the tube. It might also be noticed that when the tube is bent the spaces between the strands 30 are greater on the outer wall of the bend than when the tube is straight.

It has been found that the construction described practically eliminates the so-called back pressure and that the stream thrown by the nozzle when bent is as good as a stream when thrown by the ordinary straight nozzle. The flexible tube adds greatly to the number of uses to which the nozzle may be put since the hydraulic efficiency is practically the same whether the nozzle is bent or straight, and, therefore, the nozzle may be kept on the hose after the "around the corner" work is done and a straight nozzle is desired. The

ease with which the nozzle may be held even under high pressures is a merit which is present both when the nozzle is straight and when bent.

5 Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

- 10 1. A fire nozzle adapted to be set to direct a stream of water either straight ahead or at an angle to the end of the hose to which it is attached, the said nozzle comprising a tapered tip, a spirally wound flexible metallic tube on the said tip having a uniform internal diameter substantially equal to the internal diameter of the said tip and a coupling on the other end of the said flexible metallic tube and adjustable supporting means attached to the said flexible metallic tube adjacent each end adapted to fix the distance between the ends of the said tube.
- 25 2. A fire nozzle in accordance with the preceding claim, wherein the interior of the flexible metallic tube is grooved circumferentially, the distance between consecutive grooves measured longitudinally of the said tube being less than the diameter of the tube.

- 30 3. A fire nozzle in accordance with the preceding claims, wherein the flexible metal tube has a minimum radius of curvature when bent of more than two and one-half times its internal diameter and a straight connection on one end for attaching to a hose substantially greater in diameter than the said tube.

40 4. A fire nozzle in accordance with the preceding claim 3, wherein the flexible metal tube is of such length that it may be bent to a curve of ninety degrees.

45 5. A fire nozzle in accordance with the preceding claims, wherein the supporting means is rigid and attached to the ends of the flexible metallic tube at the sides of the latter.

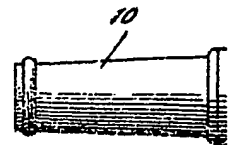
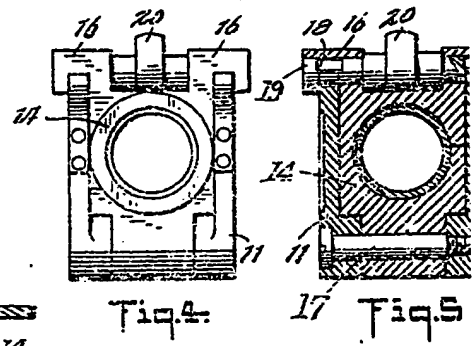
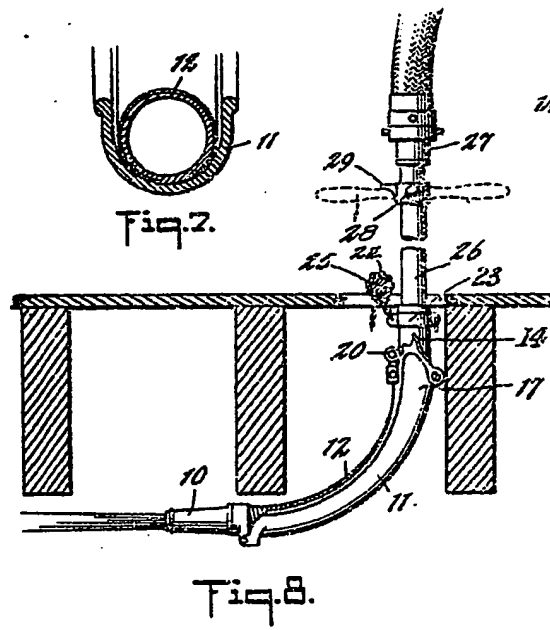
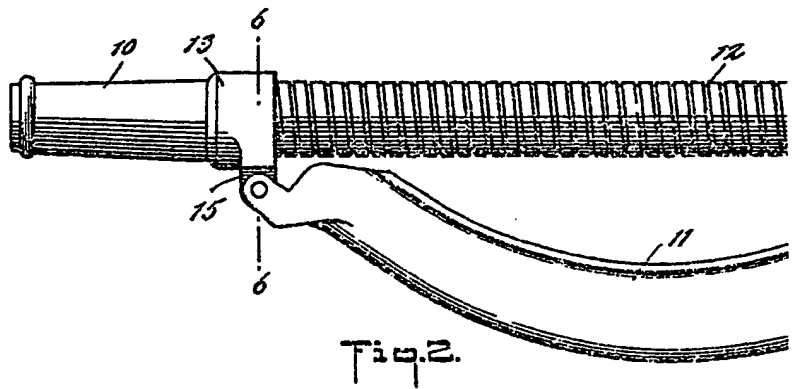
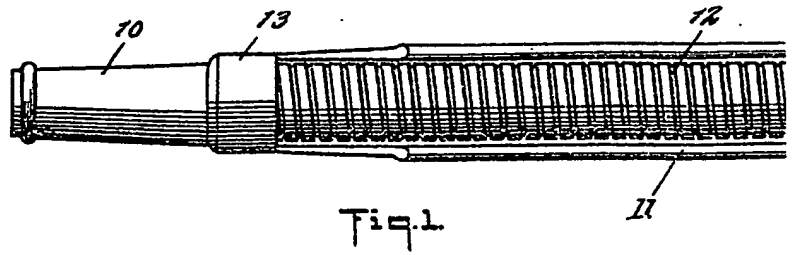
50 6. A fire nozzle in accordance with the preceding claims, wherein the supporting means is connected at one end to the tapered tip and at its other end to the hose, or to a coupling thereon, and adapted to make the said nozzle a rigid unit when set to direct a stream of water either straight ahead or at an angle to the end of the hose.

55 7. A nozzle in accordance with the preceding claim 6, wherein the supporting means is pivotally connected at each end to the tip and to a coupling connecting the flexible metallic tube and the hose, respectively, so that the said supporting means can be turned relatively to the said coupling whereby the distance between the ends of the said flexible metallic tube can be varied so that the latter is either straight or curved, and having means for locking the said supporting means in the adjusted position.

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Dated this 28th day of January, 1930.

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London, W.C. 2,  
Agents.



[This Drawing is a reproduction of the Original on a reduced scale.]

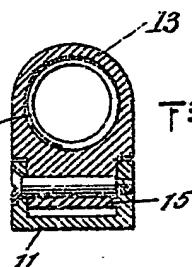
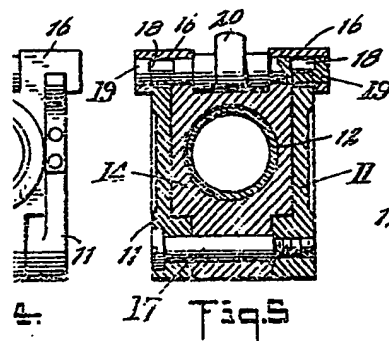
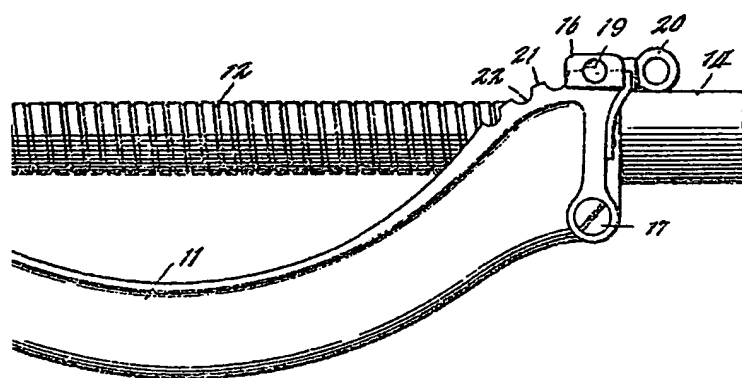
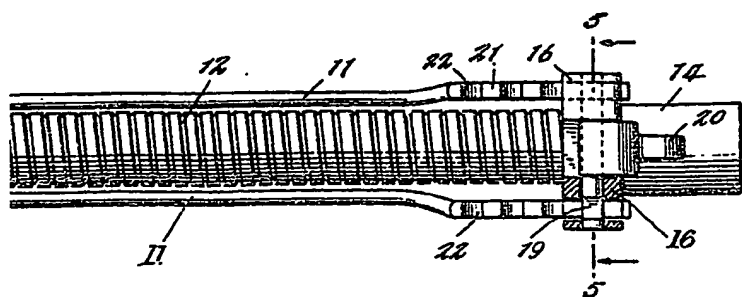


Fig. 5.

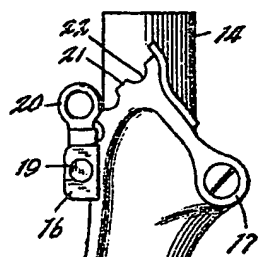


Fig. 3.

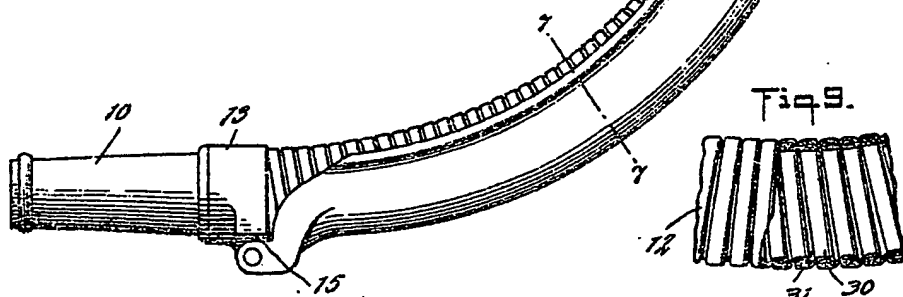
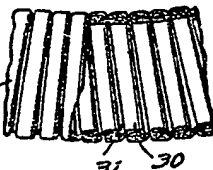
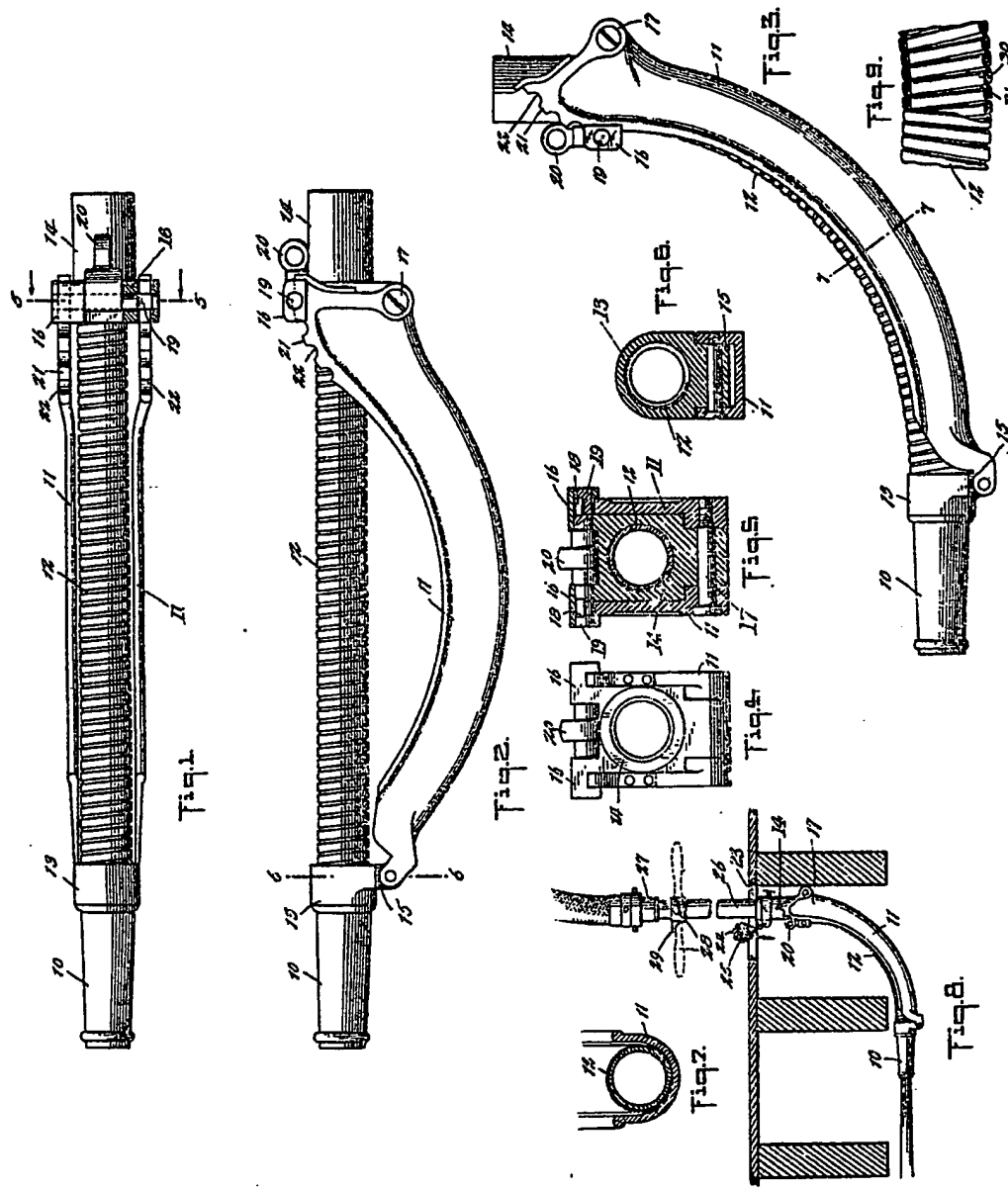


Fig. 9.





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